

Limited Reevaluation Report
Appendix B:
Formulation of Clean Air Act Compliance Plan



U.S. Army Corps of Engineers
New York District

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Clean Air Act Compliance

Basic Concepts of the Clean Air Act

1. The Clean Air Act¹ (CAA) is a long and unusually complicated statute.² In order for the reader to understand how the plan for CAA compliance was formulated and what things must be done during its implementation, it is necessary to introduce a few key CAA concepts.
2. In general, the underlying concept of the CAA is to have the federal government establish standards for air quality and to make the states responsible for meeting those standards. The standards are known as National Ambient Air Quality Standards (NAAQS). They state air quality standards in terms of the concentration of certain substances, termed criteria pollutants,³ in the air.
3. Because the concentration of criteria pollutants varies from place to place, the U.S. has been divided into air quality control regions⁴ for purposes of the CAA. If, within a given air quality control region, the NAAQS for a criteria pollutant is exceeded, that air quality region is said to be a non-attainment area⁵ with respect to that pollutant.⁶ It is possible, even common, for a given air quality control region to be a non-attainment area with respect to some pollutants and an attainment area with respect to other pollutants.⁷ All of the HDP implementation activities will take place within the New York-Northern New Jersey-Long Island, NY-NJ-CT Non-Attainment Area. (see Figure 1, below)⁸

¹ 42 U.S.C. §7401 *et seq.*

² Even the legislative history of the Clean Air Act is long and quite involved. In essence, the collection of measures that is today known as the Clean Air Act has its origin in the 1955 Air Pollution Control Act. Further measures were taken in the Clean Air Act of 1963 and the Air Quality Control Act of 1967. In 1970, these measures were collected, consolidated, and amended in the form of the Clean Air Act of 1970. It is to this incarnation of the Clean Air Act (codified as 42 U.S.C. §7401 *et seq.*), together with its 1977 and 1990 amendments, that the term “Clean Air Act” as used in this report refers.

³ Criteria pollutants are air pollutants for which EPA has set NAAQS (see 40 CFR Part 50). The list of criteria pollutants is: ozone (O₃) and ozone precursors such as oxides of nitrogen (NO_x) and volatile organic compounds (VOC), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), lead (Pb), and particulate matter (PM-10).

⁴ CAA, §107 (42 U.S.C. §7407).

⁵ A non-attainment area is an area that the EPA currently designates as not meeting one or more of the NAAQS for criteria pollutants.

⁶ With respect to some criteria pollutants, non-attainment areas are further subdivided by the degree of non-attainment. This issue will be taken up in more detail in the course of applying the review process for determining whether a federal action satisfies the general conformity rule.

⁷ There is a third status, that of being a maintenance area, that lies between being an attainment area and being a non-attainment area.

⁸ It is also sometimes referred to as the New York Northern New Jersey Connecticut Air Quality Control Region.



Figure 1. New York-Northern New Jersey-Long Island, NY-NJ-CT Non-Attainment Area for Clean Air Act Compliance



4. The states are tasked in the CAA with the planning and implementation of measures designed to achieve and maintain the NAAQS. Each state is required to produce one or more State Implementation Plans⁹ (SIPs). A SIP is an EPA-approved state plan that provides for implementation, maintenance, and enforcement of each NAAQS in each air quality control region (or portion thereof) within the state.

⁹ CAA, §110(a)(1) (42 U.S.C. §7410(a)(1)).



General Conformity

The General Conformity Concept

5. One of the key principles of the CAA is that the federal agencies, in carrying out their missions, must not make it more difficult for those responsible for implementing the SIPs to accomplish attainment and maintenance of the NAAQS. This is the essence of the so-called general conformity rule established in §176(c)(1)¹⁰ of the CAA. Oversight responsibility for conformity assurance is assigned to the agencies themselves, not to the EPA or the states.

6. The EPA has issued general conformity regulations¹¹ containing procedures and criteria for determining whether or not a proposed federal action¹² would conform with CAA implementation plans. This conformity review process consists, essentially, of answering a series of four questions with respect to the proposed federal action.

The General Conformity Review Process

7. The general conformity review process can be viewed as finding the answers to the following four questions with respect to the proposed federal action:¹³

¹⁰ The section reads, in pertinent part: No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to an implementation plan after it has been approved or promulgated. Conformity to an implementation plan means-

(A) conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards; and

(B) that such activities will not-

(i) cause or contribute to any new violation of any standard in any area;

(ii) increase the frequency or severity of any existing violation of any standard in any area; or delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

¹¹ See 40 CFR Part 93, Subpart B.

¹² Consistent with Section 176(c)(1) of the CAA, the general conformity regulations (40 CFR 93.152) define a Federal action very broadly to mean "any activity engaged in by a department, agency, or instrumentality of the Federal government, or any activity that a department, agency or instrumentality of the Federal government supports in any way, provides financial assistance for, licenses, permits, or approves, other than activities related to transportation plans, programs, and projects developed, funded or approved under Title 23 U.S.C. or the Federal Transit Act (49 U.S.C. §1601 *et seq.*)...."

¹³ This same material is frequently presented in tabular form. Below is an example taken from a Department of Energy guidance document:



- Q1 Will implementation of the project result in emission of criteria pollutants or their precursors?*
- Q2 If criteria pollutants or their precursors will be emitted, will the emission occur in a non-attainment area?*
- Q3 If criteria pollutants or their precursors will be emitted and the emission will occur in a non-attainment area, is the proposed federal action exempt?*
- Q4 If criteria pollutants or their precursors will be emitted, the emission will occur in a non-attainment area, and the proposed federal action is not exempt, are the net emissions anticipated to come from the proposed federal action equal to or below the relevant threshold rate(s)?*

Step 1. <i>Would the proposed action (alternative) cause emissions of criteria pollutants or their precursors?</i>	
YES. Go to Step 2	NO. The conformity determination requirements do not apply to the action (alternative).
Step 2. <i>Would emissions of a criteria pollutant or its precursors occur in a non-attainment or maintenance area of that pollutant (i.e., are there emissions of a pollutant of concern)?</i>	
YES. Go to Step 3	NO. The conformity determination requirements do not apply to the action (alternative).
Step 3. <i>Is the proposed action (alternative) exempt from the CAA conformity requirements?</i>	
NO. Go to Step 4	YES. The conformity determination requirements do not apply to the action (alternative).
Step 4. <i>Would the estimated total of direct and indirect emissions^s of each pollutant of concern from the proposed action (alternative) be below the threshold emissions rate[?] and also below 10 percent of the emissions inventory^d for the non-attainment or maintenance area?</i>	
NO. The conformity determination requirements apply to, and a conformity determination would be needed for that action (alternative), if selected.	YES. The conformity determination requirements do not apply to the action (alternative).

Source: U.S. Department of Energy, "Clean Air Act General Conformity Requirements and the National Environmental Policy Act Process," April 2000.

* "Pollutant(s) of concern" refers to those criteria pollutant(s) or pollutant precursor(s) (i.e., volatile organic compounds and oxides of nitrogen) that cause an area to be a non-attainment or maintenance area.

§ "Total of direct and indirect emissions" means the sum of direct and indirect emissions increases and decreases caused by the Federal action – i.e., the "net" emissions considering all direct and indirect emissions. The portion of emissions that is exempt under 40 CFR 93.153 (c), (d), and (e) is not included in the "total of direct and indirect emissions." The "total of direct and indirect emissions" includes emissions of criteria pollutants and emissions of precursors of criteria pollutants (40 CFR 93.152).

? "Threshold emissions rate" refers in this guidance to the criteria pollutant or precursor emissions rate for non-attainment and maintenance areas in 40 CFR 93.153(b)(1) and (2), respectively, below which the CAA conformity requirements would not apply.

d "Emissions inventory" means a listing, by source, of the amount of air pollutants discharged into the atmosphere of a community and which EPA or the State often uses to establish air emissions standards for the community.



8. If the review indicates all of the following:

- A1 That the project will result in emission (measured in tons per year) of one or more criteria pollutants or their precursors;*
- A2 That such emission will occur in a non-attainment area;*
- A3 That the activity generating the emissions is not an exempt activity; and*
- A4 That the amount of emissions in any one year will exceed the threshold amount of emissions; then the project's emissions must be offset in some way.*

If not, the project is already in general conformity with the relevant SIP(s) and no emission reductions or offsets need be arranged.

9. Before applying the general conformity review process to the facts of the HDP, the special terms used in the previous paragraph should be defined:

criteria pollutants - As described in an earlier note, this term refers to any pollutant with respect to which EPA has established a NAAQS.

non-attainment area – This term refers to any area that the EPA currently designates as not meeting one or more of the NAAQS for criteria pollutants. See the definition of “threshold emissions rate” below.

exempt - Certain actions are exempt from the CAA general conformity requirements, regardless of whether the action would emit pollutant(s) of concern or is in a non-attainment area for those pollutants. The conformity regulations identify specific actions that are exempt from the conformity requirements (40 CFR 93.153(c)(2)-(e)).¹⁴ These actions include those that EPA has determined would:

- result in no or *de minimus* emissions
- have emissions that are not "reasonably foreseeable"
- have emissions that are associated with a conforming program (such as prescribed burning)
- be analyzed under certain other environmental regulations (such as those implementing the Comprehensive Environmental Response, Compensation, and Liability Act), or
- be taken in response to an emergency or natural disaster.

threshold emissions rate – This term refers to the maximum amount (measured in tons per year) of a given criteria pollutant or precursor pollutant that may be emitted in a non-attainment area without triggering CAA conformity requirements, as summarized in the table below:

¹⁴ For instance, 40 CFR §93.153©(2)(ix) specifically exempts maintenance dredging activities if no new depths are required, applicable permits are secured, and disposal will be at an approved disposal site.



**Table 1 - Consolidated List of Threshold Emissions Rates,
(at or above which a conformity determination may be needed
(based on 40 CFR 93.153(b)))**

Criteria Pollutants and Air Quality Classifications	Threshold Emission Rates (tons/year)
O₃ Precursors (VOCs or NO _x)*	
Serious non-attainment	50
Severe non-attainment	25
Extreme non-attainment	10
Other O ₃ non-attainment areas outside an O ₃ transport region [§]	100
Marginal and moderate non-attainment areas inside an O ₃ transport region [§]	
VOC	50
NO _x	100
O ₃ (NO _x emissions) maintenance areas	100
O ₃ (VOC emissions) maintenance areas inside a O ₃ transport region [§]	50
O ₃ (VOC emissions) maintenance areas outside an O ₃ transport region [§]	100
CO, SO₂, or NO₂	
Non-attainment or maintenance	100
PM-10	
Moderate non-attainment	100
Serious non-attainment	70
Maintenance	100
PB	
Non-attainment or maintenance	25

* For determining total emissions levels for O₃, VOCs and NO_x are treated separately (*i.e.*, are not added together).

[§] CAA §184 designates a single ozone transport region consisting of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and the District of Columbia.

emissions offsets – This term refers to emissions reductions that the federal agency would obtain from other sources (including, potentially, another activity of the federal agency) within the same non-attainment area. Emissions offsets must be emissions reductions that are quantifiable; consistent with the SIP; surplus to reductions required by, and credited to, other applicable SIP provisions; enforceable at both the state and federal levels; and permanent within the timeframe specified by the proposed federal action whose emissions triggered the general conformity requirement.

Applicability of General Conformity to the HDP

10. Before attempting to answer the series of general conformity review questions with respect to the proposed federal action, it would be useful to determine, in the context of the HDP, precisely what the proposed federal action is. More specifically, the relevant question would be: Of what parts of the implementation of the HDP does the proposed



federal action consist?¹⁵ Does it consist of:

- all parts of the Predecessor Projects and the Recommended Plan,
- some parts of the Predecessor Projects and the Recommended Plan, or
- only the Recommended Plan?

11. There is no question that the general conformity requirements of the CAA apply to all aspects of the Recommended Plan,¹⁶ irrespective of how it is implemented. The CAA also applies to the Predecessor Projects to the extent that their implementation and implementation of the Recommended Plan is consolidated. To say the same thing in other words, the general conformity requirements of the CAA apply to some, but not all aspects of HDP implementation.

12. The CAA was significantly amended during the development of the Predecessor Projects.¹⁷ Because of the incorporation of the Predecessor Projects into the HDP, some aspects of them are subject to the latest requirements of the CAA¹⁸ and some are not. Specifically, those parts of the Predecessor Projects whose implementation will be consolidated with implementation of the Recommended Plan must be included in the general conformity analysis.¹⁹ Therefore, the general conformity review of the HDP must consider:

- emissions produced in the course of implementing the Recommended Plan plus

¹⁵ The Harbor Air Management Plan (HAMP) deals only with emissions from the construction of the project. This is because emissions stemming from O&M activities are not subject to the GCR. See 40 CFR §93.153(c)(2)(ix), which reads in pertinent part:

The requirements of this subpart shall not apply to the following Federal actions: ... (ix) Maintenance dredging and debris disposal where no new depths are required, applicable permits are secured, and disposal will be at an approved disposal site.

All three of those conditions are fulfilled in this case. Therefore, the General Conformity Rule does not apply to the O&M aspects of the HDP and the HAMP need not deal with emissions stemming from HDP O&M dredging.

¹⁶ Recall that the term “Recommended Plan” refers to the plan described in the *Chief’s Report*, and that the term “Predecessor Projects” refers, collectively, to a set of deepening projects whose complete implementation was part of the assumed without-project future condition for purposes of formulating the Recommended Plan. Recall also that the term “Harbor Deepening Project (HDP)” refers to the combination of the Predecessor Projects with the Recommended Plan as directed in the Conference Report on the Energy and Water Appropriations Act of 2002 (see *Conference Report on the Energy and Water Appropriations Act of 2002*, 107th Cong., 1st Sess., 2002. H.Rpt. 107-258).

¹⁷ Specifically, the Predecessor Projects were all authorized for construction in the Water Resources Development Act of 1986.

¹⁸ In this context, that would be the those embodied in the 1990 amendments to the CAA and the “general conformity” regulations promulgated pursuant thereto in 1993 as 40 CFR Part 93, Subpart B.

¹⁹ It is noteworthy that those parts of the Predecessor Projects on which the non-federal sponsor commenced excavation prior to signing the Project Cooperation Agreement for the HDP also required a “federal action” by the Corps of Engineers in the form of granting a permit.



- emissions produced in the course of implementing the 40 to 45 feet increment of KVK/NB-45 in contract areas 5 and 4B, plus
- emissions produced in the course of implementing the 35 to 41 feet increment of PJ-41 in Contract Area 2B West, should that occur.

General Conformity Review of the HDP

13. The purpose of the general conformity review process is to determine whether any steps need to be taken to achieve general conformity. The review process takes the form of answering the four questions set forth in Paragraph 81. For the purpose of conducting the general conformity review, it is assumed that the proposed federal action is to be implemented in the same manner as it would have been absent the CAA. To put it another way, the estimate of the emissions to be produced during the construction period of the HDP is predicated on implementation of a construction schedule designed to minimize total project cost while also allowing the channels to remain open to the safe passage of marine traffic of all types at all times.

Q1 - Will implementation of the project result in emission of criteria pollutants or their precursors?

The proposed federal action is a channel deepening project. The channel deepening is to be accomplished by dredging. The dredged material will be loaded into barges which will be pushed or towed by tug boats to the Historic Area Remediation Site (HARS), the site of one of the artificial reefs being created with rock dredged from the project, or to a transfer point from which it will be trucked to an upland placement site. In all these cases, the dredges, the tugboats and the trucks will be diesel powered. The exhaust of diesel engines typically contains at least some of all the criteria pollutants or their precursors. Therefore, the first general conformity review question must be answered in the affirmative.

Q2 - Will the emission of criteria pollutants occur in a non-attainment area?

At the time of this analysis, the New York-N. New Jersey-Long Island, NY-NJ-CT Non-Attainment Area is not a non-attainment area with respect to lead (Pb), sulfur dioxide (SO₂), or nitrogen dioxide (NO₂). Therefore, the second general conformity review question must be answered in the negative with respect to these three criteria pollutants and they need not be considered further.

The New York-New Jersey-Long Island, NY-NJ-CT Non-Attainment Area is currently classified as a severe non-attainment area with respect to oxides of nitrogen (NO_x), and volatile organic compounds (VOC), a serious non-attainment area with respect to particulate matter of 10 microns or less (PM-10), and a non-attainment area with respect to carbon monoxide (CO). Therefore the second general conformity review question must be answered in the affirmative with respect to these latter four criteria pollutants.



Q3 - Is the proposed federal action exempt?

The proposed federal action (*i.e.*, construction of the HDP, with or without consolidated implementation) will take a number of years to accomplish. According to the most current construction schedule of the project, the planned use of diesel-powered equipment will result in emissions above *de minimus* amounts in at least some years. Because there is a fairly close relationship between the amount of excavation performed and the consumption of fuel in diesel engines, the emissions are reasonably foreseeable. Moreover, the proposed federal action is not already accounted for in the relevant SIPs or part of an otherwise conforming program, is not required to be analyzed under the terms of another statute or set of regulations, and is not being undertaken in response to an emergency or natural disaster. In short, there is no reason to believe that the proposed federal action is exempt from general conformity review. Therefore, the third general conformity review question must be answered in the negative.

Q4 - Are the net emissions anticipated to come from the proposed federal action equal to or below the relevant threshold amount(s)?

Table 2 below gives the net emissions anticipated to occur as a result of carrying out the current construction schedule for consolidated implementation of the HDP. It indicates, for instance, that without further emission reduction or offsets or some combination of reductions and offsets, the threshold emission rate for NO_x in a severe non-attainment area (*i.e.*, 25 tons per year) will be exceeded in each year of the proposed federal action from 2003 through 2013, inclusive. Therefore, if general conformity with respect to NO_x is to be accomplished through the use emission reductions or emissions offsets or some combination of reductions and offsets, additional reductions or offsets or both must be obtained. The table also indicates that emissions of the other pollutants to which general conformity applies will not exceed their respective threshold emissions rate.

Table 2 – Project Net Emissions* by Year

* The term “net emissions” refers to emissions remaining after already implemented reduction and offset

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
NO _x emissions	81.8	121.11	145.26	339.16	352.8	366.47	321.95	440.33	409.64	202	74.52	15.66
NO _x reduction & offsets	95.7	95.7	25.4	0	0	0	0	0	0	0	0	0
Net NO _x emissions	-13.9	25.4	119.9	339.2	352.8	366.5	322	440.3	409.6	202	74.5	15.7
VOC emissions	3.06	4.23	1.64	3.55	7.38	7.18	6.59	8.03	7.8	4.49	1.63	0.34
VOC reduction & offsets												
Net VOC emissions												
CO emissions	23.72	33.73	33.51	68.13	76.25	69.26	61.06	82.9	77.24	38.38	14.28	3.01
CO reduction & offsets												
Net CO emissions												
PM-10 emissions	2.14	3.17	1.42	4.98	8.87	9.1	7.93	11	10.23	5.02	1.77	0.38
PM-10 reduction & offsets												
Net PM-10 emissions												

programs have been taken into account. The number of tons of emissions for each pollutant includes emissions produced in the excavation of the channels and marine transportation of the dredged material to the HARS, an in-water beneficial use site.



Achieving General Conformity

General Considerations

14. The CAA compliance plan, although embedded in the Recommended Plan, should follow the same formulation principles as Corps of Engineers civil works planning generally. Those principles are elaborated in general terms in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* and the Environmental Operating Principles, and more specifically in ER 1105-2-100 and EC 1105-2-4.

15. The selected offsets would actually consist of a combination of measures based on cost-efficiency versus pollutant levels mitigated. They could include technical corrections to the SIPs based on data collected from a detailed Marine Inventory Study. The actions considered for selecting offsets would parallel the process used for traditional mitigation, which first tries to mitigate on or near the impact site but allows for "offsite" mitigation within the watershed. In this case, "non-attainment area" will be substituted for the watershed, outlined as follows:

- Offsets will first be sought for public facilities adjacent to the project area, beginning with those of our non-Federal partner.
- If unable to meet the necessary emissions levels from offsets adjacent to the project area, they will be sought within the larger non-attainment area. These efforts will focus on public facilities within the harbor, but may look beyond its boundaries to encompass all of the non-attainment area, as necessary, to achieve CAA compliance.

Project Considerations

16. Given the assumed HDP construction schedule, it has been estimated that the threshold emission rate for NO_x will be exceeded in some years of the HDP construction period. (see Table 2, above) Therefore, it is necessary to formulate a plan that leads to compliance with the general conformity rule. Compliance requires that once the threshold emission rate has been exceeded, emission reductions or offsets sufficient to render the net emission equal to or less than zero must be put into place. There are several types of approaches that might be taken, alternatively or in combination, to accomplish that goal. In general terms, they are:

- extend the HDP construction period so as to prevent emissions in any one year reaching or exceeding the threshold level
- reduce project emissions by altering the set of equipment used or changing the way the equipment is operated, or both
- offset project emissions by causing emissions produced within the non-attainment area by others to be less than they otherwise would have been



- purchase, year by year, emission reduction credits (ERCs) generated by emission reductions accomplished by “stationary sources” within the non-attainment area

17. Each of these approaches has project costs. The project cost of CAA compliance can be described in terms of both real resources (which can be priced and stated in terms of dollars of compliance expense) and risk to project implementation. The term “project implementation risk” refers to the effects on project cost (through increased interest during construction) and project benefits (through delay in the onset of realization of benefits) of slowing or interrupting project implementation. Each of these approaches carries with it project implementation risk in one manner or another. If two approaches to CAA compliance used the same real resources (*i.e.*, had the same compliance expense) but one presented less project implementation risk than the other, the approach with the lesser project implementation risk would be the superior one in terms of project cost. Likewise, if two approaches presented the same project implementation risk but one used less real resources (*i.e.*, had lower compliance expense), the approach with the lower compliance expense would be the superior one in terms of project cost. As will become evident in the paragraphs below, there are no cases in which either compliance expense or project implementation risk can be held constant for purposes of comparing the project cost of alternative approaches. All of the alternatives presented contain trade-offs between compliance expense and project implementation risk.

18. To achieve CAA compliance by extending the construction period so as to prevent emissions from ever equaling or exceeding the threshold level in any one year, the period of construction would increase from 12 years to 118 years. Extending the construction period achieves CAA compliance with zero compliance expense, but with an increase in project cost in terms of the passage of time.²⁰ The cost of the increase in the passage of time takes the form of increase in interest during construction and a decrease in the present value of the benefits to be gained. To put this trade-off into perspective, consider the effect of a one-month delay starting in the second month of the construction period. At the current federal discount rate for water resources projects (5⁷/₈%), interest during construction (IDC) would rise by \$10.5 million and total discounted benefits would fall by \$17.9 million. The reduction in net project benefits would be \$28.4 million. The HDP is expected to emit 2,947 tons of NO_x. If no more than 25 tons were emitted per year, construction of the project would take 118 years. In light of this finding, this approach to CAA compliance can be excluded without further analysis.

19. To achieve CAA compliance by altering the set of equipment used or changing the way the equipment is operated involves direct excavation and transportation expenses and, perhaps, reductions in productivity of the equipment involved. One way to change the way equipment is operated is by using low-sulfur diesel fuel or an emulsified fuel additive in diesel-powered equipment, for instance, in the tugboats that move the barges

²⁰ This would not be an example of project implementation risk because the time pattern of the implementation would be known in advance; in other words, a certainty. Where there is not a probabilistic variable, there is no risk.



in which dredged material is transported. The price of the additive would add compliance expense and, therefore, increase project cost directly, and the fact that the effect on the productivity of the specific equipment involved is, as of this writing, unknown adds to project cost in the form of project implementation risk. In that case, the same sort of trade-off as described in the previous paragraph would occur. The same considerations apply to opportunities to alter the set of equipment used, for instance, by substituting electric dredges for diesel-powered dredges.

20. To achieve CAA compliance by offsetting project emissions by causing emissions produced within the non-attainment area by others to be less than they otherwise would have been can be accomplished in several ways. One possibility is to arrange for what is called re-powering. This is the substitution of an engine of an older design with one of newer design that features, comparatively, reduced emissions per unit of output. Table 3, below, lists the repowering of tugboats as components of several CAA compliance alternatives. Another possibility is called retrofitting. This involves the alteration of an engine to reduce its emissions, perhaps by adding a catalytic converter or a similar device to its exhaust system. Table 3, below, lists two examples of retrofitting as components of several CAA compliance alternatives, namely, “SCR²¹ on Staten Island Ferryboats” and “SCR on Project Equipment.” Each of these possibilities would increase project cost by increasing compliance expense and by increasing project implementation risk. In this case, project implementation risk would operate through the potential for unavailability of the re-powered or retrofitted equipment. The reason unavailability of the re-powered or retrofitted equipment²² would slow or interrupt project implementation is the fact that offsets must be produced contemporaneously with the emissions they are matching. If, in a given time period, the offsets are not being produced within the non-attainment area (because the re-powered or retrofitted equipment has been moved outside the non-attainment area or because it is unserviceable or simply unemployed because of bankruptcy, the pendency of other litigation, or simply lack of business), the emissions must not be produced either. If implementation of the HDP must be slowed or interrupted in order to maintain CAA compliance, an increase in IDC and decrease in discounted total benefits would occur.

²¹ “SCR” stands for selective catalytic reduction, in effect, a technique that works on the same general principles as the catalytic converter in an automobile.

²² It is interesting to note that the useful life of re-powered or retrofitted equipment is very likely to extend beyond the period of HDP construction. Thus, re-powered or retrofitted equipment would produce incidental environmental restoration in the form of emission reductions to the extent that offsets produced exceed offsets strictly required. These excess offsets would occur during the construction period in years in which net project emissions are below the peak year level. They would also extend in time into the period beyond the period of HDP construction.



Table 3: CAA Compliance Alternatives Matrix

Alternative	RISK		TIERED STRATEGIES									EMISSION REDUCTIONS		COST	
	Relative Risk	Complexity (No. of Strategies Employed)	Tier 0 - Verified Fuel Emulsion in HDP Equipment (% Equipment)	Tier 0 - PJ Electrification	Tier I - Staten Island Ferry	Tier II - KVK Tugboat Repower (Tugs)	Tier II - Tug Repower (Tugs)	Tier II - VFE in CHE (% TT)	Tier III - SCR on HDP Eqp/ ULSD	Tier IV - Emission Credits (Years Required)	Tier V - SIP	Total NOx Reductions (tons)	Surplus NOx Reductions (tons)	Estimated Cost (\$1,000's)	TEE per ton of NOx Reduced (\$)
1	Moderate	5	80%	--	--	2	--	--	--	--	--	7,930	4,983	\$20,763	\$2,627
2	Moderate	6	20-60%	--	--	2	~6	20%	--	--	--	3,981	1,034	\$29,154	\$7,323
3	Moderate	5	--	--	--	2	~3	--	--	--	--	8,534	5,587	\$20,600	\$2,414
4	Low	5	20-30%	--	--	2	~8	30-80%	--	--	--	4,132	1,184	\$20,531	\$4,969
5	Very low	4	--	--	--	2	--	70%	--	--	--	7,816	4,869	\$15,472	\$1,980
6	Very low	6	--	--	--	2	~9	80%	--	--	--	4,132	1,185	\$19,726	\$4,774
7	Very low	4	--	--	--	2	~6	--	--	--	--	9,009	6,062	\$15,280	\$1,696



21. To achieve CAA compliance through reliance on the timely purchase of ERCs would add an uncertain amount to compliance expense and would increase project implementation risk. ERCs cannot be purchased in advance because they expire at the end of the year in which they were produced. Consequently, it is not certain in advance whether a sufficient number of ERCs will be available in a given year or, if they are available, at what price they can be purchased. Project implementation would have to be slowed if an insufficient number of ERCs were produced in a given year, or suspended if no ERCs were produced in a given year.

22. Table 2, sets forth the net tons of emissions anticipated in each year of HDP construction with consolidated implementation. Table 3, sets forth an array of alternatives that would produce, year by year, a combination of emission reductions and offsets that is equal to or greater than the amounts in Table 2. Reading across the row for each alternative, an “X” indicates that a particular emission reducing or offsetting measure is a component of that alternative and a number in parentheses below the X indicates, where appropriate, the number of units of that particular measure included in the alternative.

23. The concepts of Project Expense Effectiveness (PEE) and Total Expense Effectiveness (TEE) require explanation. PEE for a given alternative is the total expense of the reductions and offsets actually acquired divided by the amount of emission reductions and offsets that are strictly needed to achieve CAA compliance.²³ TEE for a given alternative is the total cost of the of the reductions and offsets actually acquired divided by the total amount of emission reductions and offsets that are produced by the alternative.²⁴

24. In general, though, it is not possible to acquire exactly the amount of emission reductions and offsets that are strictly needed. This occurs for two related reasons. One reason is the fact that the increments of emission reduction or offset are somewhat “lumpy” in the sense that the increments are indivisible (*e.g.*, it is not possible to re-power a fraction of a tugboat; it is an all or nothing proposition) and fairly large relative to the net emission produced. Because of this lumpiness (a characteristic common to capital goods), it is unlikely that it will be possible to obtain a set of increments of emission reduction or offset that exactly matches the net emission produced. The other reason is that the emission offsets last for differing lengths of time. The useful life of a re-powered or retrofitted diesel engine is likely to extend beyond the period of HDP construction. Consequently, perfect temporal matching between the set emission offsets that can be obtained and the net emissions produced is not likely.

²³ In equation form this would be:
$$PEE = \left(\frac{\Sigma \text{capital expense} + \Sigma \text{O \& M expense}}{\Sigma \text{tons of NO}_x \text{ generated by HDP}} \right).$$

²⁴ In equation form, this would be:
$$TEE = \left(\frac{\Sigma \text{capital expense} + \Sigma \text{O \& M expense}}{\Sigma \text{total tons ns of NO}_x \text{ reduced or offset}} \right).$$



25. In light of the lumpiness and imperfect temporal matching problems,²⁵ TEE is a better measure of cost effectiveness in creating CAA compliance. TEE is the superior measure because PEE treats emission reductions and offsets in excess of those required as if they are without value. In fact, they have value in two related ways.

26. Emission reductions and offsets in excess of those strictly required serve to reduce project implementation risk. It is desirable to have some “extra” emission reductions and offsets in the CAA compliance plan to provide assurance that project implementation will not be slowed or interrupted in the event that the project produces more emissions than anticipated or that some portion of the planned emission reductions and offsets fails to occur.²⁶ If the CAA compliance plan has no “extra” emission reductions and offsets, project implementation is put at risk by commonly occurring events such as re-powered or retrofitted vessels being out of service because of an accident, unanticipated maintenance, litigation, or lack of business. As the example in paragraph 20, above, shows, the effect of even a short interruption in project implementation can reduce HDP net benefits by an amount that equals or exceeds the compliance expense of any of the CAA compliance plan alternatives. The more “extra” emission reductions and offsets there are in the CAA compliance plan, the less likely it is that a loss in project net benefits will occur. The “extra” emission reductions and offsets in the CAA compliance plan is, in effect, project implementation interruption insurance, only better.

Formulation of the CAA Compliance Plan for the HDP

27. If compliance expense were the only consideration, formulation of the CAA compliance plan would be a straightforward application of the equimarginal principle. The steps below have to be repeated for each year of the HDP construction period.

- The first step is to estimate the net emissions produced in the year of HDP construction under study. For the first several years of the HDP construction period, the net emissions produced increases each year.

²⁵ Both of these characteristics (lumpiness and imperfect temporal matching) distinguish wetland mitigation from CAA compliance. In the case of wetland mitigation, once the number of habitat units or functional units required is determined, it is possible to buy whatever number of acres and fractions of acres that would provide that number of units. Furthermore, both the project that prompts the requirement for wetlands mitigation and the land on which the mitigation takes place last into the far distant future, effectively, for purposes of the analysis of project economics, forever. In the case of CAA compliance, the event giving rise to the requirement, in this case project construction, must have a duration that is equal to or shorter than the duration of offsets.

²⁶ If, in any given year, it transpired that the amount of emission reductions and offsets that could be actually be obtained falls below the anticipated production of emissions, it is likely that the Corps of Engineers would, without being ordered to do so, slow down or halt project implementation such that the amount of emissions produced did not exceed the amount of emission reductions and offsets actually obtained. Even if that were not the case, §304 of the CAA provides for citizen lawsuits to enforce its provisions.



- The second step in the process is to find out how much emission reduction or offset can be obtained from the first available increment of each approach, and the extra project expense of obtaining that increment of emission reduction or offset. Then, calculate the ratio of emission reduction or offset to project expense for the first available increment of each approach.
- The third step is to find the approach for which the first available increment has the lowest ratio of emission reduction or offset to project expense. Take that increment and make it the first element of the CAA compliance plan for the year and subtract the amount of emission reduction or offset provided by that increment from the amount of net emission produced the HDP construction in that year.
- The fourth step is to go through the first three steps repeatedly until the sum of emission reductions and offsets “in the plan” for the year equals or exceeds the net emission for the year.
- The fifth step is to subtract whatever amount of emission reductions and offsets in the previous year’s plan that will be continued for the next year from the net emissions produced in the next year, and then begin the process for the next year at the first step.

28. The resulting plan (Alternative 7 in Table 3, above) might usefully be called the least compliance expense plan. It consists of re-powering a total of 8 tugboats at a total project expense of \$15,280,000. At \$1,696 per unit of project emissions reduced or offset, it is also the least expensive plan on a TEE basis. It is also among the alternatives that carry the lowest level of project implementation risk. It is, therefore, also the least project cost alternative and represents the NED plan.

